

Investigation of the interaction of chlorides of the alkali and alkaline earth elements in fusion: I. Ternary systems of sodium, rubidium, and calcium chlorides. V. E. Plivushchev, P. V. Kovalev, and I. V. Shakhno (Inst. Fine Chem. Technol., Moscow). *Dokl. Akad. Nauk*, 25, 855-60 (1955).—Tables and curves of m.p.s. of 325 ternary mixts. of the 3 anhyd. salts in which each varies from 0 to 100 mole % are given, with a triangular diagram of the area of liquidus. In the latter, four regions of crystn. are found: three represent the pure salts and the fourth, represents  $\text{RbCl} \cdot \text{CaCl}_2$ . No 3-component compds. were observed. Two eutectics are found:  $\text{RbCl}$  2.5%,  $\text{NaCl}$  46%, and  $\text{CaCl}_2$  52.5%, m.  $500^\circ$ , and  $\text{CaCl}_2$  11.2%,  $\text{NaCl}$  32.8%, and  $\text{RbCl}$  68.0%, m.  $605^\circ$ . Because of the hygroscopicity of  $\text{CaCl}_2$ , it was fused first and then the other compds. were added. Malcolm M. Anderson.

(2)

PLYUSHCHEV, V. Ye.; SHAKHNO, I. V.; POZHITKOVA, S. A.

Investigation of the interaction of fused alkali metal and alkaline earth chlorides. Part 2. The ternary system: sodium chloride - cesium chloride - calcium chloride. Zhur.ob.khim.25 no.6:1072-1075 Je'55.

(MLRA 8:12)

1. Moskovskiy institut tonkoy khimicheskoy tekhnologii  
(Alkaline earth chlorides) (Alkali metal chlorides)  
(Systems (Chemistry))

SHAKHNO, I. V., Cand of Chem Sci. and PLYUSHCHEV, V. Ye., Cand of Chem Sci.

"Rubidium and Cesium, Their Applications and the Methods of Producing Them," by V. Ye. Plyushchev, Candidate of Chemical Sciences, and I. V. Shakhno, Candidate of Chemical Sciences, Khimicheskaya Nauka i Promyshlennost', Vol. 1, No 5, Sep/Oct 56, pp 534-539

Methods for the production of compounds of rubidium and cesium and of these metals themselves are reviewed. The applications of these metals and of their compounds are outlined with particular attention to uses in photocells.  $\text{Cs}_2\text{Te}$ ,  $\text{Rb}_2\text{Te}$ , and  $\text{Cs}_3\text{Sb}$  photocathodes are mentioned, as is also the use of rubidium and cesium metazirconates  $\text{Me}_2\text{ZrO}_3$  and orthostannates  $\text{Me}_4\text{SnO}_4$  as luminescent substances in gas-filled electrical tubes. The medical applications of cesium eosinate are discussed on the basis of a French paper. An American patent is mentioned which proposes that the piezoelectric properties of  $\text{RbH}_2\text{PO}_4$  be utilized and that furthermore mixed crystals containing cesium, which are obtained from phosphate solutions, be used as piezoelectrics.

A suggestion that the NaOH and KOH of storage batteries be replaced fully or partially with CsOH or RbOH so that these batteries will operate more efficiently at low temperatures of the order of minus  $500^\circ\text{C}$  is discussed on the basis of another American patent.

In conclusion, the statement is made that there are plentiful supplies of raw materials containing rubidium and cesium and that the production of these metals in the USSR should be expanded greatly in the near future, notwithstanding the difficulty of processing some of the raw materials. Furthermore, the suggestion is made that carnallite, which is used to an ever-increasing extent for the production of magnesium and potassium, be also processed for rubidium.

A bibliography consisting of 33 references, 3 of them USSR, is appended to the article.

*Sum 1239*

PLYUSHCHEV, V.Ye.; ~~SHAKHNO~~ I.V. (Moskva).

Development and present state of the technology of rubidium cesium,  
and their compounds. Usp. Khim. 26 no.8:944-964 Ag '57. (MLRA 10:8)  
(Rubidium) (Cesium)

SHAKHNO, I.V.

AUTHOR

URAZOV, G.G., Member of the Academy  
SHAKHNO, I.V. 20-3-33/67  
20-3-33/67

TITLE

On Monotropic Transformation of Spodumene.  
(K voprosu o monotropnom prevrashchenii spodumena -Russian)  
Doklady Akademii Nauk SSSR, Vol 113, Nr 2, pp 361-363 (U.S.S.R.)  
Received 6/1957 Reviewed 7/1957

PERIODICAL

ABSTRACT

Among the numerous lithium minerals spodumene was above all, investigated; its thermal properties were the most interesting: fusibility and transformations at high temperatures. The fusion point values obtained 50 years ago (1880-1890) are too low and not up to date. About one decade later the area 920-980 was regarded as zone of fusion (Endell and Rieke). In reality the specific gravity and the reflective index remain unchanged up to 920. At about 950 spodumene passes into a different highly symmetrical modification. The volume abruptly increases by 24%. The specific gravity increases from  $d=3.147$  (20) to  $d=2.367$  (138). Reflective index is  $n=1.66$  from 20 to 920, then (at 980) it suddenly changes and increases to 1.519 and remains constant at higher temperatures. The authors call this zone- the zone of thermal transformation- the spodumene. The new modification is irreversible and polymorphous. The spodumene-modification found in nature was called  $\alpha$ -spodumene, the new one  $\beta$ -spodumene. This suggestion is considered correct by the authors, as there are no chemical, but only physical and optical differences in comparison with the

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natural spodumene. All spodumene-minerals occurring in nature are to be regarded as a metastable form in relation to the  $\beta$ -form. The practical consequence of these investigations was the burning of spodumene containing rock in order to enrich it with lithium. The time needed by burning for the purpose of producing  $\beta$ -spodumene does not only depend on the place of discovery but also on the ore-deposit, as in nature pure spodumene does not occur, but only the most different phases of efflorescence. In consequence of hypergene modifications the kaolinization of the spodumene increases, furthermore albitization takes place. A thermal analysis can determine kaolinization. From the curves of temperature effects (schedule 2) it is obvious that, together with an accelerated heating, the temperature of initial transformation rises and the interval of transformation is extended. The influence of the velocity of warming up has to be taken into consideration in connection with the solution of a number of problems by thermal analysis, which, unfortunately, is not always done. The mechanical addition of pure quartz and calcium sulfate (schedule 3 compared with schedule 2) has a lowering effect on the  $\alpha$ - $\beta$ -transformation temperature of the spodumene. With increasing quantities of admixture the influence is intensified. Potassium sulfate has a weaker effect. The admixtures contained in the spodumene itself (up to 10 according to Gabriel and possibly even more) have a remark-

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appropriate experiments at 0 - 70°. Solvents used were  $\text{CH}_3\text{OH}$ ,  $\text{C}_2\text{H}_5\text{OH}$ ,  $n\text{-C}_3\text{H}_7\text{OH}$ ,  $n\text{-C}_4\text{H}_9\text{OH}$ ,  $\text{iso-C}_4\text{H}_9\text{OH}$  (primary) and  $\text{iso-C}_5\text{H}_{11}\text{OH}$  (primary). In the system with  $\text{LiCl}$  5 - 6 days were allowed for the system to reach equilibrium. 6 - 7 days were allowed for the others. The solid phase, which was in equilibrium with the saturated solution was the original starting chloride. Distinct phases formed by the dissolution of  $\text{LiCl}$  in  $\text{CH}_3\text{OH}$  and in  $\text{C}_2\text{H}_5\text{OH}$  at 0°. They represented  $\text{LiCl} \cdot 3\text{CH}_3\text{OH}$  and  $\text{LiCl} \cdot 4\text{C}_2\text{H}_5\text{OH}$  (Ref 6). Table 1 shows the extreme solubility (in weight per cent) plus the range of temperature during the investigation. From this data the following peculiarities are emphasized: 1) The solubility of each chloride increases gradually with temperature. Only with the formation of the solvated form does the curve show a divergence, corresponding to the second branching. 2) This solubility increases with increasing molecular weight of both the normal and iso alcohols. 3)  $\text{LiCl}$  is striking for its relatively high solubility in all alcohols. With the increasing atomic number the solubility of

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the chloride changes rapidly, so that in the transition from  
LiCl to KCl it increases by 100 to 10 000 times, while it  
increases twelve-fold in the transitions from RbCl to CsCl.  
There are 1 table and 6 references, 2 of which are Soviet.

ASSOCIATION: Kafedra tekhnologii redkikh i rasseyannykh elementov Moskovskogo  
instituta tonkoy khimicheskoy tekhnologii im. M. V. Lomonosova  
(Chair of Technology of the Rare and Dispersed Elements of the  
Moscow Institute for Precision Chemical Technology imeni M. V.  
Lomonosov)

SUBMITTED: October 31, 1957

Card 3/3



SHAKHO, I. V.

SHAKHO, I. V.

**AUTHORS:** Plyuchev, V. Ye., Simanov, Yu. Z., Shakhno, I. V.  
**TITLE:** The High Temperature Synthesis of the Rubidium Aluminum Silicate (Vysokotemperaturnyy sintez aluminosilikata rubidiya)  
**PERIODICAL:** Zhurnal neorganicheskoy khimii, 1958, Vol. 3, No. 9, pp. 2155-2157 (USSR)  
**ABSTRACT:** In the present paper the results of the investigations of the high temperature synthesis of the rubidium aluminum silicate of the composition  $Rb_2Al_2Si_2O_{10}$  were communicated. The reaction of the interaction between  $\beta$ -spodumene and  $Rb_2CO_3$  was carried out at temperatures of 850, 910, and 1000°C in the case of different ratios of the components. The reaction is carried out according to the following scheme:  
 $2Al_2SiO_5 + Rb_2CO_3 \rightarrow 2RbAl_2Si_2O_{10} + Li_2SiO_3$   
 The interaction between  $\beta$ -spodumene and  $Rb_2CO_3$  lasts two hours. The samples obtained were radiographically analyzed. The thermographic analysis showed that a polymorphic transformation of the low temperature modification into the high temperature

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modification takes place at 1054-1069°C. In the case of a second heating of  $RbAl_2Si_2O_{10}$  no transformation could be found. The results show that the aluminum silicate of rubidium is similar to leucite  $KAlSi_3O_8$  with tetragonal lattice  $a = 13.36$  Å and  $c = 13.72$  Å. There are 1 figure, 1 table, and 11 references, 7 of which are Soviet.

**ASSOCIATION:** Moskovskiy gosudarstvennyy universitet im. M. V. Lomonosova (Moscow State University imeni M. V. Lomonosova) Moskovskiy institut tekhnicheskoy tekhnologii im. M. V. Lomonosova (Moscow Institute of Fine Chemical Technology imeni M. V. Lomonosova)

**SUBMITTED:** July 8, 1957

Card 2/2

AUTHORS: Plyushchev, V. Ye., Shakhno, I. V. SOV/156-58-4-45/49

TITLE: Investigation of the Interaction Process of Pollucite With Mixtures of Oxides and Chlorides of Calcium (Izucheniye protsessy vzaimodeystviya pullutsita so smes'yu okisi i khlorida kal'tsiya)

PERIODICAL: Nauchnyye doklady vysshey shkoly. Khimiya i khimicheskaya tekhnologiya, 1958, Nr 4, pp 785-788 (USSR)

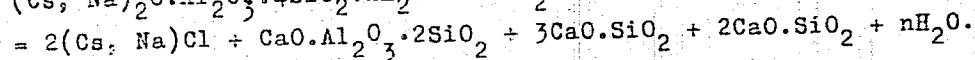
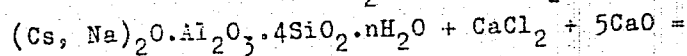
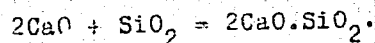
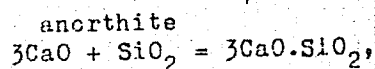
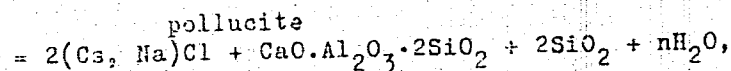
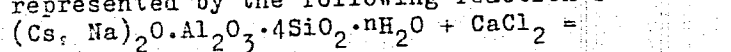
ABSTRACT: The results of the investigation of the technological process for the production of CsCl from pollucite was described. All experiments were carried out with absolutely pure pollucite. Slight impurities such as Cu, Sn, Mn, Fe, Pb, Li, K, Rb, and Ge were determined by spectrum analysis. On the treatment of pollucite with a mixture of CaO and CaCl<sub>2</sub> the alkali metals were transformed into chlorides. The phase that is insoluble in water, i. e. the solid phase, consists of the following compounds according to radiographic and thermal analyses: 1) anorthite, 2) tricalcium silicate, and 3) dicalcium silicate in the

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form of  $\gamma$ ,  $\beta$  and  $\alpha'$ . The presence of 3 modifications of  $2\text{CaO} \cdot \text{SiO}_2$  was confirmed by thermal analysis. The interaction mechanism of pollucite with a mixture of  $\text{CaO}$  and  $\text{CaCl}_2$  is represented by the following reaction scheme:



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There are 1 figure, 1 table, and 10 references, 7 of which  
are Soviet.

ASSOCIATION: Kafedra tekhnologii redkikh i rasseyannykh elementov  
Moskovskogo instituta tonkoy khimicheskoy tekhnologii  
im. M. V. Lomonosova (Chair of Technology of Rare and  
Trace Elements at the Moscow Institute of Fine Chemical  
Technology imeni M. V. Lomonosov)

SUBMITTED: February 13, 1958

Card 3/3

5(1,2)

SOV/153-58-6-10/22

AUTHORS: Plyushchev, V. Ye., Shakhno, I. V.

TITLE: Investigation of the Interaction of Minerals Containing Rare Alkali Elements, With Salts and Oxides in the Sintering and Fusion Processes (Issledovaniye vzaimodeystviya mineralov, sodershaichikh redkiye shchelochnyye elementy, s solyami i oksidami v protsessakh spevaniya i splavleniya). I. On the Production of Cesium Chloride by the Interactions of Pollucite With Calcium Oxide and -Chloride (I. O poluchenii khlorida tseziya pri vzaimodeystvii pollutsita s oksidom i khloridom kal'tsiya)

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Khimiya i khimicheskaya tekhnologiya, 1958, Nr 6, pp 54-60 (USSR)

ABSTRACT: In several hundreds of papers on the processing of the raw material with a content of rare elements mostly purely technological problems are discussed. The investigations of theoretical problems have been lagging far behind the former type of investigations. The paper under consideration serves the purpose of partly filling this gap. It is the first of three papers dedicated to the processing of pollucite

Card 1/4 (Cs.Na)  $[AlSi_2O_6]nH_2O$ . The well-known processing methods for

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Investigation of the Interaction of Minerals Containing Rare Alkali Elements, With Salts and Oxides in the Sintering and Fusion Processes. I. On the Production of Cesium Chloride by the Interactions of Pollucite With Calcium Oxide and -Chloride

pollucite can be divided into 3 groups: 1) acid methods, 2) direct cesium production methods from ores, and 3) the methods mentioned in the title. A survey of scientific publications on said method is given (Refs 1-13). The methods of the 3rd group, sintering and fusion, are at present not very numerous (Ref. 13). This method mentioned in the subtitle has a number of advantages over other methods, as the compound desired by the technologist can be isolated almost directly. However, with a low cesium content (compared with other alkali metals), the reprecipitation of  $3\text{CsCl} \cdot 2\text{SbCl}_3$  or a preliminary fractionated crystallization are necessary for a separation from sodium. The authors employed said method of pollucite decomposition for the production of pure  $\text{CsCl}$ . Subsequently, the results of the chemotechnological investigation of the  $\text{CsCl}$  production process by interaction with a  $\text{CaO}$ - and  $\text{CaCl}_2$  mixture are described. The experimental part contains discussions of: Study of the roles played by individual reagents in the decomposition

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Investigation of the Interaction of Minerals Containing Rare Alkali Elements, With Salts and Oxides in the Sintering and Fusion Processes. I. On the Production of Cesium Chloride by the Interactions of Pollucite With Calcium Oxide and -Chloride

process of pollucite (Table 1 with CaO, Table 2 with NaCl, KCl, CaCl<sub>2</sub> and BaCl<sub>2</sub>). From this it is obvious that the last-mentioned 4 chlorides cannot be used as independent reagents for pollucite decomposition. CaCl<sub>2</sub> yielded the best results. However, the cesium yield from the concentrate falls noticeably at 900°. The role played by CaO must, however, not be underestimated. After all, CaCl<sub>2</sub> by itself is not able to fully complete the reaction. The shift of the reaction is secured only by CaO, as it favors the formation of Al and Si into insoluble compounds. Table 3 presents data thereon, as well as on the interactions with other mixtures. The interaction of pollucite with CaO and CaCl<sub>2</sub> yields the total cesium quantity in a water-soluble state in the form of CsCl. There are 3 tables and 18 refer-

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Investigation of the Interaction of Minerals Containing Rare Alkali Elements, With Salts and Oxides in the Sintering and Fusion Processes. I. On the Production of Cesium Chloride by the Interactions of Pollucite With Calcium Oxide and -Chloride

ences, 4 of which are Soviet.

ASSOCIATION: Kafedra tekhnologii redkikh i rasseyannykh elementov; Moskovskiy institut tonkoy khimicheskoy tekhnologii imeni M. V. Lomonosova  
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SUBMITTED: January 9, 1958

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5(1,2)

SOV/153-2-4-22/32

AUTHORS: Plyushchev, V. Ye., Shakhno, I. V.

TITLE: Investigation of the Interaction of Minerals Containing Alkali Elements With Salts and Oxides in Sintering and Melting Processes. II. Thermographical Investigation of the Interaction Process of Pollucite With Calcium Oxide and Calcium Chloride

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Khimiya i khimicheskaya tekhnologiya, 1959, Vol 2, Nr 4, pp 582 - 588 (USSR)

ABSTRACT: The procedure (at high temperatures) mentioned in the subtitle is one of the most popular among various methods of processing pollucite to cesium compounds. Its superiority was confirmed by the authors. They showed the role played by individual reaction participants in the decomposition of the mineral mentioned by technological investigation, and examined the optimum conditions of interaction (Ref 1). The role played by each of the constituents of the charge could be defined, and the nature of the water-soluble components of the sintering products explained by means of the results shown here. Pure pollucite was used which was controlled by means of cathode rays according to G. F. Komovskiy and O. N. Lozhnikova (Ref 2).

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Investigation of the Interaction of Minerals Containing SCV/153-2-4-22/32  
Alkali Elements With Salts and Oxides in Sintering and Melting Processes.  
II. Thermographical Investigation of the Interaction Process of Pollucite  
With Calcium Oxide and Calcium Chloride

The table (p 583) shows the results of the investigation mentioned in the subtitle. Hence it appears that pure roasted pollucite does not undergo any transformations between 20 and 950°. The ideas (still insufficient at present) on the character of the interaction between CaO and CaCl<sub>2</sub> do not influence the results and conclusions. The heating curves of mixtures containing pollucite do not differ from curves of substances or mixtures not containing pollucite. Thus, they give no indication as to the reaction process. The more difficult task of deciphering the thermograms of the sintering products can be solved by comparing the thermal variations of the initial components and the thermal variations caused by the interaction of the charge components with those depending on the properties of the water-soluble salt system formed. The latter variations are caused by the interaction of excess CaCl<sub>2</sub> with cesium- and sodium chloride. These salts are formed because of the reaction of CaCl<sub>2</sub> with pollucite (Ref 10). On account of the data on this interaction, an approximate computation can be made

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Investigation of the Interaction of Minerals Containing SOV/153-2-4-22/32  
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of the  $\text{CsCl}$ - and  $\text{NaCl}$ -quantity formed by this reaction, and the excess  $\text{CaCl}_2$  which together form the soluble salt system. The thermal transformations in this system can easily be found by means of heating curves with the use of the melting-point diagram of the system  $\text{NaCl-CsCl-CaCl}_2$ . Upon comparison of this melting-point diagram with data on the fusibility of the salt mass of the sintering products, it may also be concluded that the sintering of pollucite with  $\text{CaO}$  and  $\text{CaCl}_2$  proceeds under optimum conditions only if little melt is formed. This increases the exchange degree of the reaction. The thermogram of pollucite with  $\text{CaO}$  is simplest among all thermograms of sintering products. No reaction occurs between pollucite and  $\text{CaO-CaCl}_2$  under optimum conditions for the interaction of pollucite with the  $\text{CaO}$ -mixture. Figure 1 shows the heating curve of the sintering product of pollucite with  $\text{CaCl}_2$ , figure 2 that with  $\text{CaO}$  and  $\text{CaCl}_2$ . They are thoroughly analyzed<sup>2</sup>, and compared with each other. The results of the thermographical investigation will be published in an additional paper. There are 2 figures, 1 table, and 11 references,

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Investigation of the Interaction of Minerals Containing SOV/153-2-4-22/32  
Alkali Elements With Salts and Oxides in Sintering and Melting Processes.  
II. Thermographical Investigation of the Interaction Process of Pollucite  
With Calcium Oxide and Calcium Chloride

9 of which are Soviet.

ASSOCIATION: Moskovskiy institut tonkoy khimicheskoy tekhnologii imeni M. V.  
Lomonosova; Kafedra tekhnologii redkikh i rasseyannykh elementov  
(Moscow Institute of Fine Chemical Technology imeni M. V. Lomo-  
nosov; Chair of Technology of Rare and Dispersed Elements)

SUBMITTED: April 21, 1958

Card 4/4

PLYUSHCHEV, V.Ye.; SHAKHNO, I.V.

Reactions of minerals containing rare alkali elements with salts  
and oxides in the processes of sintering and fusion. Part 3:  
745-750 '59. (MIRA 13:8)

1. Moskovskiy institut tonkoy khimicheskoy tekhnologii imeni  
M.V. Lomonosova, kafedra tekhnologii redkikh i rasseyanykh elementov.  
(Pollucite) (Calcium oxide) (Calcium chloride)

5(1, 2)  
AUTHORS:

Plyushchev, V. Ye., Simanov, Yl. P.,  
Shakhno, I. V.

SOV/20-125-2-26/64

TITLE:

On the  $\beta$ -Modification of Spodumene (O beta-modifikatsii  
spodumena)

PERIODICAL:

Doklady Akademii nauk SSSR, 1959, Vol 125, Nr 2, pp 334-336  
(USSR)

ABSTRACT:

Spodumene constitutes the most important industrial lithium source, and is characterized by the formula  $\text{Li}_2\text{O} \cdot \text{Al}_2\text{O}_3 \cdot 4\text{SiO}_2$ . However, the percentage of the components in spodumene varies as it never occurs pure (Refs 1, 2). Many elements are present in spodumene as isomorphic substituents, and cannot be removed mechanically (Refs 2, 3). Most of them replace lithium in the crystal lattice. From the processes in nature it becomes obvious that this lithium replacement can attain significant dimensions (Ref 4). This is the main characteristic of spodumene erosion by which the mineral is deprived of its value. Sodium plays the most conspicuous role in this process. Although spodumene for a long time used to figure with the aluminosilicates, there is no doubt today that it constitutes a double

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On the  $\beta$ -Modification of Spodumene

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silicate of lithium and aluminium (Ref 5). Natural spodumene (mostly called  $\alpha$ -spodumene) is characterized above all by the monotropic transition, between 950 and 1100°, into a high-temperature modification (  $\beta$ -modification or  $\beta$ -spodumene, Ref 7). This irreversible transition is of great practical importance, as in the roasting of spodumene-containing rocks it can be employed for their enrichment in lithium. Unlike  $\alpha$ -spodumene the  $\beta$ -modification is brittle and comminutes easily. Thus a concentrate can be obtained by means of sifting. Contrary to the case of the  $\alpha$ -modification there are no conclusive data on the structure of  $\beta$ -spodumene. It may be assumed that the symmetry of the latter is higher. The authors made an x-ray study of the latter. The results (Table 1) can be considered satisfactory only for 54 lines of the x-ray photograph. The paper under consideration was started under the direction of the late Academician G. G. Urazov ( for many years Head of the Kafedra tekhnologii tonkikh neorganicheskikh produktov, MITKhT = Chair of the Technology of Fine Inorganic Products, at the Institute mentioned in the 1st Association). There are 1 table and 11 references, 3 of which are Soviet.

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On the  $\beta$ -Modification of Spodumene

SOV/20-125-2-26/64

ASSOCIATION: Moskovskiy institut tonkoy khimicheskoy tekhnologii  
im. M. V. Lomonosova (Moscow Institute of Fine Chemical  
Technology imeni M. V. Lomonosov) Moskovskiy gosudarstvennyy  
universitet im. M. V. Lomonosova (Moscow State University  
imeni M. V. Lomonosov)

PRESENTED: October 30, 1958, by I. V. Tananayev, Academician

SUBMITTED: September 15, 1958

Card 3/3



SHAKHNO, I.V.; PLYUSHCHEV, V.Ye.

Fusibility diagrams in systems formed by rubidium and cesium chlorides with calcium chloride. Zhur.neorg.khim. 5 no.5: 1172-1173 My '60. (MIRA 13:7)

1. Moskovskiy institut tonkoy khimicheskoy tekhnologii im. M.V.Lomonosova.

(Rubidium chloride) (Cesium chloride)  
(Calcium chloride)

PHASE I BOOK EXPLOITATION SOV/5747

Vsesoyuznoye soveshchaniye po redkim shchelochnym elementam. 1st, Novosibirsk, 1958.

Redkiye shchelochnyye elementy; sbornik dokladov soveshchaniya po khimii, tekhnologii i analiticheskoy khimii redkikh shchelochnykh elementov, 27-31 yanvarya 1958 g. (Rare Alkali Elements; Collection of Reports of the Conference on the Chemistry, Technology, and Analytical Chemistry of Rare Alkali Elements, Held 27-31 January, 1958) Novosibirsk, Izd-vo Sibirskogo otd. AN SSSR, 1960. 99 p. 1000 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Sibirskoye otdeleniye. Khimiko-metallurgicheskiy institut.

Resp. Ed.: T. V. Zabolotskiy, Candidate of Technical Sciences; Members of Editorial Board: A. S. Mikulinskiy, Professor, Doctor of Technical Sciences, A. T. Logvinenko, Candidate of Technical Sciences, F. F. Barkova, Candidate of Chemical Sciences; Ed.: V. M. Bushuyeva; Tech. Ed.: A. F. Mazurova.

Card 1/5

Rare Alkali Elements; Collection (Cont.)

SOV/5747

PURPOSE : This book is intended for chemical engineers and technicians working in metallurgical and mining operations and related enterprises.

COVERAGE: The collection contains reports which deal with the physical and analytical chemistry of rare alkali elements and their compounds and their reactions with mineral ores and salts. Methods of extraction and modern analytical techniques and equipment are also discussed. No personalities are mentioned. References accompany individual articles.

TABLE OF CONTENTS:

Urazov, G. G. [Deceased], V. V. Plyushchev, Yu. P. Simanov, and I. V. Shakhno. [Moskovskiy institut tonkoy khimicheskoy tekhnologii im. (M.V.) Lomonosova - Moscow Institute of Fine Chemical Technology imeni M. V. Lomonosov]. High-Temperature Modification of Spodumene 5

Plyushchev, V. Ye. [Moscow Institute of Fine Chemical Technology

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Rare Alkali Elements; Collection (Cont.)

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Petrov, Ye. S. [Sibirskoye otdeleniye AN SSSR - Siberian Division of the AS USSR]. Some Relationships in the Interaction of Salts of Alkali Metals With Silica and Alumina and Properties of the Products Formed 43

Logvinenko, A. T. and G. D. Uryvayeva. [Khimiko-metallurgicheskiy institut Sibirskogo otdeleniya AN SSSR - Institute of Chemical Metallurgy of the Siberian Department of the Academy

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Rare Alkali Elements; Collection (Cont.)

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Kozlov, A. S. [Khimicheskiy fakul'tet Moskovskogo gosudarstven-  
nogo universiteta - Chemistry Department of Moscow State University].  
A New (Turbidimetric) Method of Determining Small Amounts of  
Cesium With the Aid of Cesium and Cadmium Ferrocyanides 79

Galkina, N. K., and M. M. Senyavin. [Institut geokhimii i  
analiticheskoy khimii AN SSSR - Institute of Geochemistry  
and Analytical Chemistry of the Academy of Sciences USSR]  
Chromatographic Separation of Mixtures of Alkali Metals 87

Zabrodin, N. I., A. A. Nechayeva, and T. V. Korobochkina.  
[Vsesoyuznyy nauchno-issledovatel'skiy institut galurgii - All-  
Union Scientific Research Institute of Halurgy]. The Content  
of Rare Alkali Elements in Natural Salts of the Soviet Union  
and Prospects of Its Utilization in Industry 97

AVAILABLE: Library of Congress (QD 172.A4v8)

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JA/rsm/jw  
11-27-61

PLYUSHCHEV, V.Ye.; SHAKHNO, I.V.; SHKLOVER, L.P.

Interaction of minerals containing rare alkaline elements with salts and oxides during sintering and melting. Part 8: Reactions taking place in the interaction of spodumene with a mixture of calcium carbonate and chloride. Izv.vys.ucheb.zav.; khim.i khim. tekh. 5 no.1:133-140 '62. (MIRA 15:4)

1. Moskovskiy institut tonkoy khimicheskoy tekhnologii imeni Lomonsova, kafedra tekhnologii redkikh i rasseyannykh elementov.  
(Spodumene) (Lithium chloride) (Calcium carbonate)

PLYUSHCHEV, V.Ye.; SAVEL'YEVA, M.V.; SHAKHNO, I.V.

Cesium propionate, butyrate, and isovalerate. Zhur.neorg.khim.  
7 no.9:2078-2081 S '62. (MIRA 15:9)  
(Cesium salts) (Acids, Organic)



SHAKHNO, I.V.; FLYUSHCHEV, V.Ye.; TITUNINA, Ye.M.; SAMUSEVA, R.G.

Solubility in the system  $\text{Na}_2\text{CrO}_4 - \text{Cs}_2\text{CrO}_4 - \text{H}_2\text{O}$  at 25 and  
50°C. Zhur. neorg. khim. 8 no.6:1466-1469 Je '63.  
(MIRA 16:6)

(Alkali metal chromates)  
(Solubility)

SHAKHNO, I.V.; FLYUSHCHEV, V.Ye.; AVZHIYEVA, Ye.M.

System  $\text{Na}_2\text{Cr}_2\text{O}_7 - \text{Cs}_2\text{Cr}_2\text{O}_7 - \text{H}_2\text{O}$  at 25° and 50°C.

Zhur. neorg. khim. 10 no.5:1237-1240 My '65.

(MIRA 18:6)

1. Moskovskiy institut tonkoy khimicheskoy tekhnologii imeni  
Lomonosova.

CHAKHRO, I.V.; PLYUSHCHEV, V.Ye.; AVZHIYEVA, Ye.M.

The system  $\text{Na}_2\text{CrO}_4 - \text{Rb}_2\text{CrO}_4 - \text{H}_2\text{O}$  at 25 and 50°C. Zhur. neorg.  
khim. 10 no.2:552-555 1965. (MIRA 18:11)

1. Moskovskiy institut tonkoy khimicheskoy tekhnologii imeni  
Lomonosova. Submitted April 10, 1964.

SHAKHNO, K. U.

PHASE I

TREASURE ISLAND BIBLIOGRAPHICAL REPORT

AID 630 - I

BOOK

Call No.: AF499332

Author: SHAKHNO, K. U.

Full Title: COLLECTED EXAMINATION PROBLEMS IN MATHEMATICS WITH  
SOLUTIONS

Transliterated Title: Sbornik konkursnykh zadach po matematike  
s resheniyami

PUBLISHING DATA

Originating Agency: Leningrad State "Order of Lenin" University  
im. A. A. Zhdanov

Publishing House: Leningrad University Publishing House

Date: 1951 No. pp.: 217 No. of copies: 10,000

Editorial Staff

Responsible Editor: N. P. Yerugin

Contributors: Profs. G. M. Fikhtengol'ts, D. K. Faddeyev, N. P. Yerugin

PURPOSE: To inform the graduates of secondary schools of requirements  
in mathematics in institutions of higher learning and thus establish  
a continuous tie between the lower and upper instruction levels.

TEXT DATA

Coverage: The book contains 416 problems and questions in mathematics,  
which were offered at the entrance competitive examinations at the  
Universities of Leningrad and Moscow, at the Leningrad Polytechnical

1/2

Sbornik konkursnykh zadach po matematike s resheniyami

AID 630 - I

and Electrotechnical Institutes and other higher institutions of learning in 1946-50. The problems are systematized in eleven groups (pp. 5-40) and followed by detailed solutions (pp. 41-216). The groups include: algebraic formulae and equations, progressions, logarithms, combinations and Newton's binomial, trigonometric formulae and equations and their transformations, plane and stereometric problems in geometry, and miscellaneous problems.

No. of References: None

Facilities: None

2/2

SHAGINO, K. U.

Sbornik konkursnykh zadach po matematike s resheniyami [Problems from mathematical examinations with the answers]. Izd. 2-e. Leningrad. Izd-vo LGU, 1953. 236 p.

SO: Monthly List of Russian Accessions. Vol. 6 No. 7 October 1953

SHAKHNO, K.U.; BARKOVSKIY, I.V., redaktor; GURDZHIYEVA, A.M., tekhnicheskii redaktor

[Collection of problems in mathematics; manual for teachers of the 8-10th classes] Sbornik zadach po matematike; posobie dlia uchitelei 8-10 klassov. Izd. 2. Leningrad, Gos. uchebno-pedagog. izd-vo Ministerstva prosveshcheniia RSFSR, Leningradskoe otd-nie, 1954. 210 p. (MLRA 7:10)

(Mathematics--Problems, exercises, etc.)

SHAKHO, Konstantin Ustinovich; CHEPOVA, T.K., redaktor; MEL'NIKOVA,  
G.G., redaktor; IVANOV, V.V., tekhnicheskii redaktor.

[Manual on elementary mathematics] Spravochnik po elementarnoi  
matematike. [Leningrad] Izd-vo Leningradskogo univ., 1955. 206 p.  
(Mathematics) (MLBA 8:10)



YERUGIN, Nikolay Pavlovich; SHAKHO, K.U., redaktor; SHCHIMELEVA, Ye.V.,  
redaktor; IVANCOVA, A.V., tekhnicheskiiy redaktor.

[Implicit functions] Neizvnyye funktsii. Leningrad, Izd-vo Leningrad-  
skogo univ., 1956. 57 p. (Functions) (MLRA 9:5)

YERUGIN, Nikolay Pavlovich; SHAKHNO, K.U., otvetstvennyy redaktor;  
SHECHMELEVA, Ye.V., redaktor; VODOLAGINA, S.D., tekhnicheskii  
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[The Lappo-Danilevskii method in the theory of linear differential  
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1956. 106 p. (MLRA 9:9)  
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GOLDBERG, Abram Girshevich; SHAKHNO, K.U., red.; RAKOVITSKIY, I.G., tekhn.red.

[Functions and their study. Derivatives, Teacher's manual] Funktsii  
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Gos.uchebno-pedagog. izd-vo M-va prosv. RSFSR, Leningr. otd-nie,  
1957. 67 p. (MIRA 11:3)  
(Functions)

SHAKHNO, Konstantin Ustinovich; BARKOVSKIY, I.V., red.; LEONT'YEVA, L.A.,  
tekhn.red.; BOL'SHAKOV, V.A., tekhn.red.

[Handbook on mathematics; textbook for students in grades 8-10]  
Spravochnik po matematike; posobie dlia uchashchikhsia 8-10 kl.  
Leningrad, Gos. uchebno-pedagog. izd-vo M-va prosv. RSFSR, 1957.  
214 p. (MIRA 11:4)

(Mathematics--Study and teaching)

SHAKHNO, Konstantin Ustinovich; GUSAK, A.A., red.; BELEN'KAYA, I.Ye.,  
tekhnred.

[Textbook on mathematics for persons entering institutions  
of higher learning; problems presented on competitive examinations  
and their solutions] Posobie po matematike dlia postupaiushchikh  
v vysshie uchebnye zavedeniia; sbornik konkursnykh zadach po mate-  
matike s resheniiami. Izd.4. Minsk, Izd-vo Belgosuniv. im. V.I.  
Lenina, 1960. 233 p. (MIRA 13:7)  
(Mathematics--Problems, exercises, etc.)

SHAKHNO, Konstantin Ustinovich; IL'INA, M.Ye., red.; ZHUKOVA, Ye.G.,  
tekhn. red.

[How to prepare for entrance examinations to institutions of  
higher learning; mathematics] Kak gotovit'sia k priemnym ek-  
zamenam v vuz; matematika. Leningrad, Izd-vo Leningr.univ.,  
1961. 246 p. (MIRA 15:1)

(Mathematics---Study and teaching)

SHAKHNO, Konstantin Ustinovich; GUSAK, A.A., red.; MORGUNOVA, G.M.,  
tekh. red.

[Handbook on mathematics for students entering institutions of higher learning; mathematical problems and solutions given on competitive examinations] Posobie po matematike dlia postupaiushchikh v vysshie uchebnye zavedeniia; sbornik konkursnykh zadach po matematike s resheniami. Izd.6. Minsk, Izd-vo M-va vysshego, srednego spetsial'nogo i professional'nogo obrazovaniia BSSR, 1962. 245 p.

(MIRA 15:6)

(Universities and colleges--Entrance requirements)

(Mathematics--Problems, exercises, etc.)

SHAKHNO, Konstantin Ustinovich; KOSTYUKOVETS, F.T., red.

[Collection of difficult problems in elementary  
mathematics] Sbornik zadach po elementarnoi matematike  
povyshennoi trudnosti. Minsk, Vysshiaia shkola, 1964. 523 --.  
(MIRA 17:5)



SHAKHID, Konstantin Ustinovich; VEREVKINA, N.M., red.

[How to prepare for the entrance examinations in  
mathematics at a school of higher education] Kak gotovit'-  
sia k priemnym ekzamenam v vuz po matematike. Izd.3., ispr.  
i dop. Moskva, Vysshiaia shkola, 1965. 271 p.  
(MIRA 18:5)

L 9661-66 EWT(d)/EWP(c)/ENP(v)/T/EWP(k)/EWP(l)/ETC(m) WW

ACC NR: AP5027608

SOURCE CODE: UR/0135/65/000/011/0042/0044

AUTHOR: <sup>44.55</sup>Brinberg, I. L. (Candidate of technical sciences); <sup>44.55</sup>Grudkin, D. A. (Engineer);  
<sup>44.55</sup>Dobrushin, M. S. (Engineer); <sup>44.55</sup>Shakhnov, A. E. (Engineer)

ORG: TsNIITMASH

TITLE: Standardized semiautomatic CO<sub>2</sub> shielded welding machines

SOURCE: Svarochnoye proizvodstvo, no. 11, 1965, 42-44

TOPIC TAGS: gas welding, arc welding, semiautomatic welding power, welding equipment, welding equipment component, welding technology / PGSh-5 semiautomatic CO sub 2 shielded welding machine, PGSh-5 semiautomatic CO sub 2 shielded welding machine

ABSTRACT: Considering the diversity of the work parts welded by the CO<sub>2</sub>-shielded method, a large number of different units of welding apparatus and equipment is needed for this purpose. In this connection, the author describes a set of standardized components (Fig. 1) which can be assembled together as needed for the semiautomatic CO<sub>2</sub> shielded welding machines designed by the TsNIITMASH Central Scientific Research Institute of Technology and Machine Building. Thus, e.g. depending on the type and position of the seams, the rigidity of electrode wire, and the welding conditions, either a gun-type or a burner-type holder has to be used. If considerable depth of fusion is required, a fitting assuring minimal overhang of electrode wire is needed.

Card 1/5

UDC: 621.791.85.037

L 9661-66

ACC NR: AP5027608

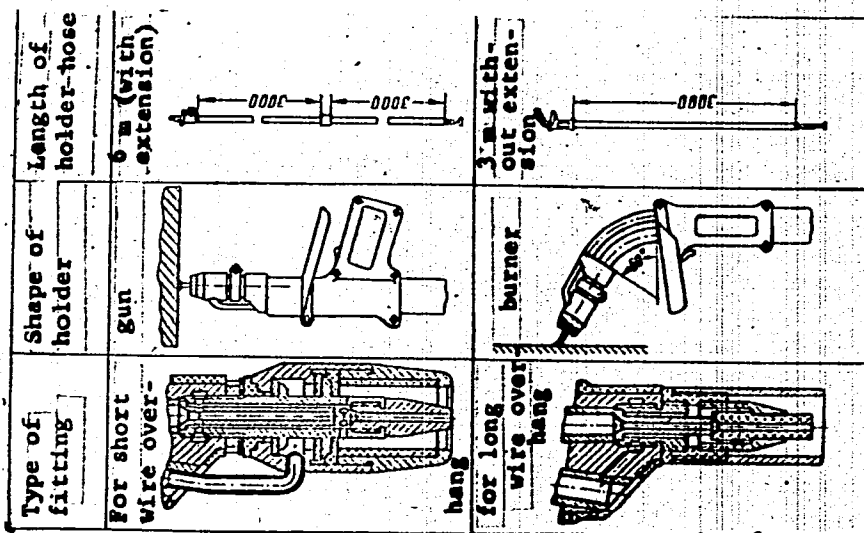


Fig. 1, a. Variants of accessories for TsNIITMASh-designed standardized semiautomatic welding machines

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ACC NR: AP5027608

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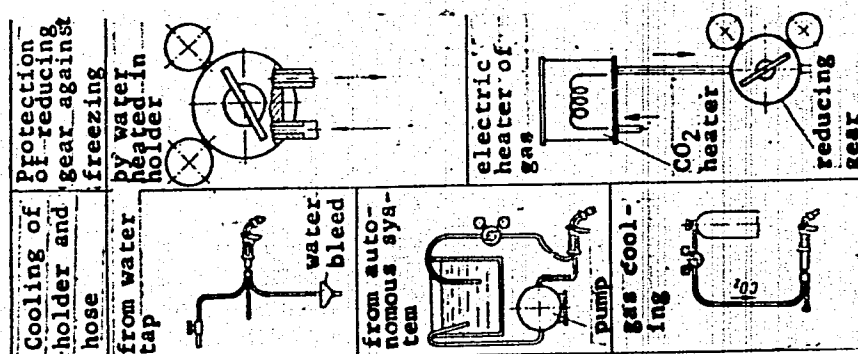


Fig. 1, b. Variants of accessories for TsNIITMASH-designed standardized semiautomatic welding machines

Card 3/5

L 9661-66

ACC NR: AP5027608

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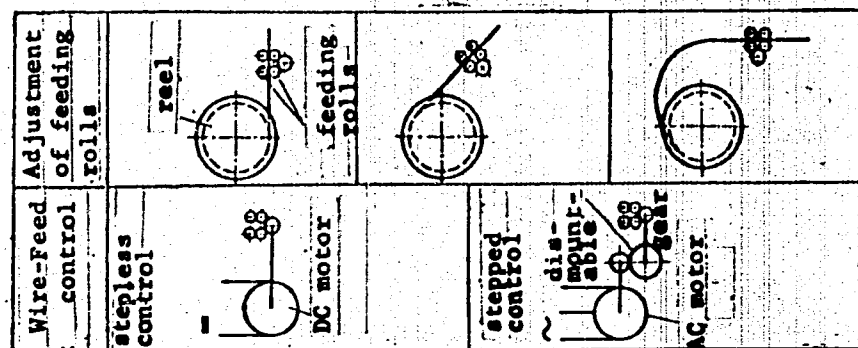


Fig. 1, c. Variants of accessories for TsnITMAsh-designed standardized semiautomatic welding machines

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L 9661-66

ACC NR: AP5027608

High-speed welding requires water cooling of the current-conducting nose and holder fitting. Precision welding requires use of an adjustable-RPM DC motor to drive the electrode-feed mechanism. In addition, two basic modifications of the semiautomatic welding machine are needed in virtually any type of large-scale welding operations: a machine with a smoothly adjustable electrode feeding rate that is dependent on the arc voltage, and a machine with an independent electrode feeding system. Accordingly, the TsNIITMASH has designed two standardized semiautomatic machines of this kind: the PGSh-4M and the PGSh-5. The PGSh-4M makes it possible to use electrode wire of 1.6 and 2.0 mm diameter for low-voltage welding, and thus helps to save scarce electrode wire of smaller diameters, while the PGSh-5 can be used for regular welding operations which do not require frequent changes of welding regime. Orig. art. has: 2 figures, 1 table.

SUB CODE: 11, 13/ SUBM DATE: none/ ORIG REF: 000/ OTH REF: 000

Card

5/5

SHAKHNOV, I.F. (Moskva)

Steady motion of a gas with a variable supply of mass and energy.  
PMTF no.3:117-119 S-O '61. (MIRA 14:8)  
(Gas flow) (Dynamics)

33592

S/207/61/000/004/003/012  
E032/E514

10.1230 1327

AUTHOR: Shakhnov, I.F. (Moscow)

TITLE: On the non-adiabatic flow of a perfect gas past a slender body pointed in front at a high supersonic velocity

PERIODICAL: Akademii nauk SSSR. Siberskoye otdeleniye. Zhurnal prikladnoy mekhaniki i tekhnicheskoy fiziki, no.4, 1961, 114-117

TEXT: The author is concerned with the steady state non-adiabatic flow of a non-viscous, non-thermally conducting gas, having a constant specific heat, past slender bodies pointed in front. The equations of motion, continuity and heat flow to the body are written down in a cartesian set of coordinates attached to the body and are simplified by assuming that the perturbation of the flow by heat sources are of the same order of magnitude or smaller than the perturbations due to the body itself (Ref.1: Chernyy G.G. Flow of a gas with a large supersonic velocity. Fizmatgiz, 1959). It is also assumed that the maximum relative thickness of the body is small so that its second and

Card 1/2



On the non-adiabatic flow ... 33592  
S/207/61/000/004/003/012  
EO32/E514

higher powers can be neglected compared with unity. It is shown that the final set of equations contains three dimensionless parameters. A similarity criterion is derived for the flow past affine-similar bodies subject to similar heat release. The general analysis is then specialised to the case of supersonic flow past a flat plate at zero angle of attack with a rectangular region to which heat is uniformly supplied. The region is in immediate contact with the plate. The general differential equations were integrated numerically on an electronic computer. The pressure distribution over the plate was obtained and it was found that the pressure rises along the plate to a maximum value and then tends to a lower constant value. The general conclusion is that the non-adiabatic flow past slender bodies pointed in front with a high supersonic velocity is equivalent to a two-dimensional steady state motion of a gas ejected by a piston with a simultaneous supply of heat from outside. A third-order nonlinear differential equation, which must be solved numerically, is derived for the latter case. Acknowledgments are expressed to G. G. Chernyy for advice. There are 2 figures and 2 Soviet-bloc references.

SUBMITTED: May 24, 1961  
Card 2/2

10.3100

31072

S/179/61/000/005/003/022

E031/E426

26.2181

AUTHOR: Shakhnov, I.F. (Moscow)

TITLE: On disturbances in a supersonic flow caused by discrete or continuous heat sources

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Otdeleniye tekhnicheskikh nauk. Mekhanika i mashinostroyeniye. v.5, 1961, 16-21

TEXT: The flow is assumed to be steady and the disturbances sufficiently small for second order terms to be neglected. The fluid is an ideal gas of constant heat capacity; only two-dimensional flows are considered. It is shown that the disturbances to the pressure caused by a point heat source at the origin, propagate along characteristics which pass through the origin, and are proportional to the strength of the source. In the case of non-adiabatic flow over a curved body, with heat sources just outside it, it is shown that the stream lines become less convex. It is also shown that the disturbances caused by the surface and those caused by the heat sources are superimposed. By proper choice of the strength and position of the heat sources, the shock waves can be made to vanish. There are 1 figure and Card 1/2

51072

S/179/61/000/005/003/022

E031/E426

On disturbances in a supersonic ...

2 Soviet-bloc references.

SUBMITTED: April 18, 1961

Card 2/2

X

10.3100 1327

33556  
S/179/61/000/006/005/011  
E032/E314

AUTHOR: Shakhnov, I.F. (Moscow)

TITLE: Application of the method of small perturbations to the calculation of the nonadiabatic supersonic flow of an ideal gas over a flat plate

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Otdeleniye tekhnicheskikh nauk. Mekhanika i mashinostroyeniye, no. 6, 1961, 37 - 41

TEXT: The author considers the nonadiabatic flow over a flat plate at zero angle of attack. It is assumed that the gas is ideal, i.e. non-viscous, non-thermally conducting. The non-adiabatic supersonic flow was discussed by the author in a previous paper (Ref. 1: this journal, no. 5, 1961) and the equations derived in that publication are used in the present paper. It is assumed that there is a layer of thickness  $h$  and length  $L$  adjacent to the surface of the plate in which the amount of heat given to the unit mass of gas per unit time is constant. An estimate is made of the main parameters which determine the flow both in the latter zone and in the region

Card 1/2

X

Application of ....

33556  
S/179/61/000/006/005/011  
EO32/E314

external to it. It is shown that the presence of a rectangular heated zone is equivalent (for the adiabatic part of the flow, i.e. that part of the flow which does not pass through the zone) to flow past a curvilinear surface whose equation can be explicitly expressed in terms of the heat supplied to the zone, the Mach number and the dimensionless length of the zone. A heat wake is formed behind the zone and the pressure and velocity within it are the same, while the density is smaller, as compared with the region outside the above zone. The thermal wake contains a "core" in which the density remains constant. The limits of applicability of the linearized theory of Ref. 1 are indicated. There are 2 figures and 2 Soviet-bloc references. ✓

SUBMITTED: April 18, 1961

Card 2/2

S/124/62/000/006/010/023  
D234/D308

10.3100  
AUTHORS:

Shakhnov, I. F. and Frost, V. A.

TITLE:

Flow of a supersonic stream of ideal gas past a plane plate in presence of volume heat liberation

PERIODICAL:

Referativnyy zhurnal, Mekhanika, no. 6, 1962, 23, abstract 6B113 (Tr. Mosk. fiz.-tekhn. in-ta, 1961, no.7, 110-123)

TEXT: Supersonic stabilized flows of an ideal gas in presence of volume heat liberation is considered. The authors investigate as an example the flow at a zero angle of attack past a plane plate with adjoining rectangular zone of uniform heat liberation. This liberation of heat causes a deviation of the flow which in its turn causes a condensation discontinuity to appear at a certain distance from the zone of heat liberation. The authors give a formula for determining the point of generation of the condensation discontinuity as the point of intersection of the first family characteristics, nearest to the plate. The results of calculations ac- ✓ B

Card 1/2

Flow of a supersonic ...

S/124/62/000/006/010/023  
D234/D308

According to this formula are close to the results obtained by the method of characteristics. Calculations by the method of characteristics show that in the case of a thin aerodynamical profile and small heat access the vorticity of the flow is small. Neglecting the vorticity, the authors linearize the equation of velocity potential and reduce it to a Poisson equation with the right-hand side depending on the distribution of the quantity of heat supplied to a mass unit of gas in a time unit. Results of calculating pressure distribution on the plate with an adjoining rectangular zone of uniform heat liberation are given for Mach's values of power of the heat sources. As can be seen from the graphs given, in the case of small heat liberation the results obtained according to the linear theory are close to those obtained by the method of characteristics. [Abstracter's note: Complete translation.]

Card 2/2

ACCESSION NR: AP4043902

S/0179/64/000/004/0154/0157

AUTHOR: Shakhnov, I. E. (Moscow)

TITLE: Flow of an ideal, supersonic, non-adiabatic gas around a flat plate

SOURCE: AN SSSR. Izvestiya. Mekhanika i mashinostroyeniye, no. 4, 1964, 154-157

TOPIC TAGS: rocket, aerodynamics, fuel combustion, gas flow, nonadiabatic gas flow, supersonic nonadiabatic gas flow, supersonic gas flow, rocket fuel combustion

ABSTRACT: The author considers the flow of an ideal supersonic gas around a flat plate with a heat release zone connected with the streamlines and adjoining the plate surface. It is assumed that the heat release rate is directly proportional to the fuel combustion rate as calculated by a second order kinetic equation with a temperature relationship derived from the law of Arrhenius. It is also assumed that the flow is uniform and rectilinear in the initial section and that the fuel is equally mixed with the air in a stoichiometric relationship. The pressure distribution on the plate surface is described using the characteristic method on the basis of numerical solutions. For simplification of non-adiabatic flow, the Cartesian coordinates are transformed into curvilinear ones. The equation for

Card 1/6



ACCESSION NR: AP4043902

stationary continuum flow of a perfect gas is expressed as:

$$\rho q \frac{\partial q}{\partial s} = - \frac{\partial p}{\partial s}, \quad \rho q^2 \frac{\partial \theta}{\partial s} = - \frac{\partial p}{\partial n}, \quad \frac{\partial \ln \rho q}{\partial s} = - \frac{\partial \theta}{\partial n} \quad (1)$$

And after transformations and additions:

$$\rho^* \frac{d\eta^{*2}}{d\rho^*} = - \frac{2}{\gamma_1 M_1^2}, \quad \frac{d}{ds} \left( c_p T^* + \frac{\gamma_1 - 1}{2} M_1^2 q^{*2} \right) = (\gamma_1 - 1) \gamma^* R^* T^* \frac{c_p}{M} \quad (2)$$

with

$$\rho^* = \frac{p^*}{R^* T^*}, \quad M^2 = M_1^2 \frac{q^{*2}}{\gamma^* R^* T^*} \quad (3)$$

showing the density and  $M^2$ . Further, the article considers that heat release is due to chemical reactions. For a perfect gas (non-viscous, without thermal conductivity and thermal convection), the heat input  $dQ$  to the elementary fluid volume moving at a speed of  $q$  is in direct ratio to the mass  $dm$  of burnt fuel:

$$dQ = \Delta H dm \quad \text{and} \quad c = \frac{\Delta H}{1 + \alpha L_0} \frac{dm^*}{dt} \quad \left( m^* = \frac{m}{m_1} \right) \quad (4)$$

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ACCESSION NR: AP4043902

For illustrating the chemical kinetics of fuel combustion, the following expression is used in the article:

$$\frac{d[v_f]}{dt} = k \sqrt{T} [v_f] [v_o] \exp \left\{ -\frac{E}{R_0 T} \right\} \quad (5)$$

where the molar fuel concentration of fuel and oxygen per unit volume are included. For calculating the burnt fuel, this relationship is transformed to:

$$\frac{dm^0}{dt} = \frac{L_0}{\beta + L_0 M} \frac{D p^0 [1 - m^0] [1 - \beta m^0]}{\sqrt{r R}} \exp \left\{ -\frac{E^0}{T^0} \right\} \quad n = \frac{r k p_0 L_0}{M_0 \sqrt{T_1 R_1}} \quad E^0 = \frac{E}{R_0 T_1} \quad (6)$$

where  $M_0$  is the molar mass of oxygen,  $n$  is the initial density of the mixture and  $r$  is the initial weight proportion of oxygen in the oxidizer. The formulas used in cases including many components are the same as for a gas consisting of one component. The article next considers the change in density during combustion. Fig. 1. in the Enclosure shows fuel combustion adjoining the plate, this phenomena being considered the same as in a pipe of constant section. As the fuel burns up the density drops until the pressure begins to rise due to expansion, caused by fuel combustion far from the wall. The type of fuel combustion illustrated in Fig. 2. of the Enclosure does not develop as fast as in the first case, and the heat is released mainly while expanding. Thus, the degree of pressure

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ACCESSION NR: AP4043902

Increase is lower and the field of constant pressure at maximum density is lacking. The field of constant pressure at maximum density is lacking. "The author expresses his thanks to Ye. S. Shchetinkov for proposing the problem and to Yu. G. Fedayev for his valuable observations while performing the tests and discussing the paper." Orig. art. has: 2 figures and 10 equations.

ASSOCIATION: none

SUBMITTED: 29Oct63

ENCL: 02

SUB CODE: ME, PR

NO REF SOV: 004

OTHER: 001

Card 4/6

ACCESSION NR: AP4043902

ENCLOSURE: 01

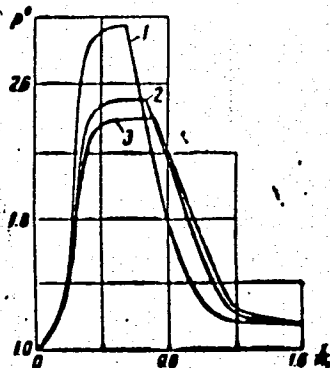


Figure 1.

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ACCESSION NR: AP4043902

ENCLOSURE: 02

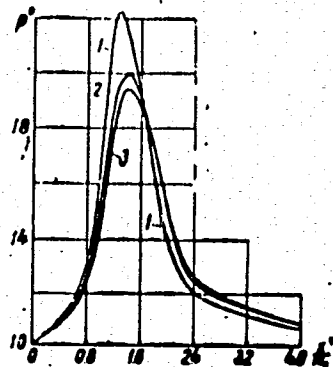


Figure 2.

Card 6/6

SHAKINOV, I.F. (Moskva)

Supersonic nonadiabatic perfect gas flow about a flat plate.  
Izv. AN SSSR Mekh. i mashinostr. no.4&154-157 J1-Ag'64  
(MIRA 17&8)

54775-65 EPA/EWT(1)/EWP(m)/EWT(m)/EWP(w)/EPF(c)/EPR/T/FGS(k)/EWA(c)/  
EWA(1) Pd-1/Pr-4/Ps-4/Pt-7/Pi-4 EM/WW/JW/WE UR/0373/65/000/003/0017/0024  
ACCESSION NR: AP5016228

AUTHOR: Shakhnov, I. F. (Moscow)

TITLE: The ignition of a stoichiometric mixture in the laminar supersonic boundary layer on a flat plate

SOURCE: AN SSSR. Izvestiya. Mekhanika, no. 3, 1965, 17-24

TOPIC TAGS: supersonic combustion, ignition, igniter, ignition source, combustion, airbreathing propulsion

ABSTRACT: An analysis was made of the ignition and combustion process induced when a stoichiometric fuel (pentane, isobutane, gasoline, kerosine or T-5 jet fuel)-air mixture flows at supersonic velocity (up to M 5) under zero angle of attack over an impermeable flat plate maintained at a constant temperature. It was assumed that the pressure drop in the free stream is zero and that ignition takes place in the laminar boundary layer on the plate. The analysis based on the use of boundary layer equations yielded expressions for the minimum length of the plate required for ignition as a function of kinetic and flow parameters (Mach number, Schmidt number, free stream and wall temperatures, activation energy, and heat of combustion). Calculations of the location of the flame front and ignition zone were made for free

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L 54775-65

ACCESSION NR: AP5016228

stream temperatures from 300 to 1000K and Schmidt numbers of 0.4 to 40 at a constant wall temperature of 1500K. The calculations showed that an increase in Mach number and a decrease in the Schmidt number lead to a decrease in the minimum plate length. The latter was found to be very sensitive to a change in the free stream temperature. For instance at  $M = 5$ ,  $S = 4$ , and  $E = 40$  kcal/mole, the ratio of the minimum plate lengths at 300 and 1000K amounts to 94:1. The use of the boundary layer equations in the present analysis is permissible when the ignition delay time is long enough so that the effect of the chemical reactions becomes pronounced only at a given distance from the leading edge of the plate where the boundary layer has already developed. As the flame front develops, the zone of incipient chemical reaction is shifted in the transverse direction from the plate into the stream. This is accompanied by an increase in flow velocity causing a longitudinal elongation of the reaction zone. Only the initial section of the plate in which the reaction zone is close to the plate wall may thus be considered critical. Orig. [FV]

ASSOCIATION: none

SUBMITTED: 02Nov64

NO REF SOV: 006

Card 2/2

ENCL: 00

OTHER: 002

SUB CODE: FP,ME

ATD PRESS: 4028



SHAKHIDV, I.P. (Moskva)

Ignition of a stoichiometric mixture in the laminar supersonic  
boundary layer of a flat plate. Izv. AN SSSR. Mekh. no.3:17-24.  
My. Ia '65. (MIRA 18:7)

SENKOV, A.M., professor, doktor tekhnicheskikh nauk; SHAKHNOV, I.I.,  
inzhener.

New method for designing improved diaphragm dynamometers. [Trudy]  
VNIMI no.30:210-213 '56. (MLBA 9:11)  
(Dynamometer)

B4216

S/057/62/032/012/017/017  
B104/B166

26.11/10

AUTHOR: Shakhnov. I. I.

TITLE: On Neuringer's error

PERIODICAL: Zhurnal tekhnicheskoy fiziki, v. 32, no. 12, 1962, 1495-1496

TEXT: The American Aviation Corporation published a study by D.L. Neuringer on the theory of magnetohydrodynamic generators. It is shown that the variation problem for determining the conditions under which the useful power of the generator is greatest contains wrong assumptions. The Euler equation

$$\sigma k B + \sigma \lambda_1 B^2 + \sigma k \lambda_2 B - m \frac{d}{dx} \left( \frac{\lambda_1}{y} \right) - \omega p y \frac{d\lambda_1}{dx} - m u \frac{d\lambda_2}{dx} = 0,$$

$$\frac{k^2 \sigma}{y^2} + \frac{\sigma k \lambda_1 B}{y^2} + \frac{\sigma k \lambda_2}{y^2} - \frac{m \lambda_1}{y^2} \frac{du}{dx} - \omega p u \frac{d\lambda_2}{dx} = 0,$$

$$\frac{d\lambda_1}{dx} + \omega u y \frac{d\lambda_2}{dx} = 0.$$

together with the equation of motion and the equation of the conservation

Card 1/2.

1

On Neuringer's error

S/057/62/032/012/017/017  
B104/B186

of energy is a system which has no unique solutions. The determinant

$$\begin{vmatrix} 0 & 0 & -\frac{m\lambda_1}{y^2} & 0 & -\omega p u \\ 0 & 0 & 0 & -1 & -\omega u y \\ \frac{m\lambda_1}{y^2} & 0 & 0 & -\frac{m}{y} & -(\omega p y + \mu) \\ 0 & \frac{m}{y} & 1 & 0 & 0 \\ \omega p u & \omega u y & \omega p y + \mu & 0 & 0 \end{vmatrix}$$

of this system, consisting of the coefficients of the first derivatives of the functions sought, is of odd order and antisymmetric, hence equal to zero.

ASSOCIATION: Fiziko-tekhnicheskiy institut im. A. F. Ioffe AN SSSR,  
Leningrad (Physicotechnical Institute imeni A. F. Ioffe  
AS USSR, Leningrad)

SUBMITTED: April 20, 1962

Card 2/2

CHEKMAREV, I.B. (Leningrad); SHAKHNOV, I.I. (Leningrad)

Helical motion of a conducting gas between coaxial permeable  
cylinders in the presence of a longitudinal electric field.  
(MIRA 17:7)

PMTF no. 6:3-6 N-D '63.

L 2458-66 EWT(1)/EWP(m)/EPA(sp)-2/EPA(w)-2/T-2/EWA(m)-2 IJP(c)  
 ACCESSION NR: AP5020718 UR/0057/65/035/008/1359/1363

AUTHOR: Shakhnov, I. I.; Chelmarev, I. B.

TITLE: Influence of electric and magnetic fields on the electron temperature in a magnetogasdynamic channel

SOURCE: Zhurnal tekhnicheskoy fiziki, v. 35, no. 8, 1965, 1359-1363

TOPIC TAGS: plasma flow, plasma device, electric energy conversion, electric field, magnetic field, electron temperature, magnetogasdynamics

ABSTRACT: The authors calculate the variations of electron temperature during one-dimensional flow of a weakly ionized plasma in crossed electric and magnetic fields. The calculations were undertaken because of their interest in connection with plasma energy converters. The plasma is assumed to consist of two components with widely differing ionization potentials and to flow transversely to the magnetic field. The electric field is assumed to be perpendicular to the magnetic field but not necessarily to the flow velocity. The hydrodynamic equations for the electron gas with electron diffusion and source terms are quoted from Chapman and Cowling's monograph and are simplified by neglecting electron inertial and vis-

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L 2458-66

ACCESSION NR: AP5020718

3  
cosity. The electron source function is fixed by assuming equilibrium between the electrons and the atoms and ions of the easily ionized plasma component. With these equations there is calculated the ultimate electron temperature in the flowing plasma and also the behavior of an initially isothermal plasma during transition to the asymptotic state. It is found that the flow in crossed fields considerably increases the electron temperature above the ion temperature. Numerical results for a mixture of argon and potassium vapor are presented graphically, and it is concluded that the optimum Mach number is greater than that calculated by D.T. Swift-Hook and I.K.Wright (J. Fluid Mech., 5, 1, 97, 1963). Orig. art. has 30 formulas and 2 figures.

ASSOCIATION: Fiziko-tekhnicheskii institut im. A.F.Ioffe AN SSSR, Leningrad  
(Physico-technical Institute, AN SSSR) 44, 55

SUBMITTED: 17Nov64

ENCL: 00

SUB CODE: ME

NR REF SOV: 003

OTHER: 003

BVK  
Card 2/2

SHAKHNOVA, L.V:

~~Effectiveness of direct and backcrossing in poultry breeding. Agro-~~  
biologiya no.1:143-145 Ja-F '58. (MIRA 11:2)

1. Vsesoyuznyy nauchno-issledovatel'skiy institut ptitsevodstva.  
(Poultry breeding)



USSR / Farm Animals. Poultry.

Abs Jour : Ref Zhur - Biologiya, No 5, 1959, No. 21308

Author : ~~Shakhnova~~, L. V.

Inst : Not given

Title : Selecting Basic Breeds in Interbred Crossings

Orig Pub : Ptitsevodstvo, 1958, No 4, 29-32

Abstract : At the Arzhenka sovkhos an experiment was carried out in order to clarify the effectiveness of direct and reciprocal crossing between Russian white and Zagorskaya white breed hens. Each of the groups consisted of 200 heads which were raised at the same feeding and keeping conditions. It was found that 8.9 percent more chicks were produced in direct crossing (Russian white hens X Zagorskaya white breed roosters) as in reciprocal crossing (Zagorskaya white hens X Russian white roosters). The weight of hybrids in

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USSR / Farm Animals. Poultry.

Abn Jour : Ref Zhur - Biologiya, No 5, 1959, No. 21308

direct crossing was by 9.7 percent and in reciprocal crossing by 18.9 percent larger than that of Russian white chickens. According to their measurements, the hybrids of direct crossing excel the Russian white chickens. At a 20-day long fattening period, the weight gain amounted to 53.3 percent in reciprocally crossed hybrids, to 39.3 percent in directly crossed hybrids, and to 40.5 percent in Russian white breed hens. For a 10-month period, egg production amounted to 122 eggs in the directly crossed hybrids, and to 137.5 eggs in reciprocally crossed hybrids. Since it produces best results, reciprocal crossing (hens of generally useful breeds X roosters of egg producing breeds) may be recommended both for economic and breeding purposes.

-- K. V. Tatariyskaya

Card 2/2

81

SHAKHNOVA, L. V.

Cand Agr Sci - (diss) "Increasing the productivity of crossbreed  
hens by means of using various combinations of breeding stocks."  
Moscow, 1961. 16 pp; (Moscow Veterinary Academy of the Ministry  
of Agriculture RSFSR); 200 copies; price not given; (KL, 7-61 sup,  
253)

LASHKEVICH, A.M.; TERENT'YEVA, A.A.; IVANOVA, L.S.; BORODULINA, M.A.;  
 VELICHENKO, I.N.; NIKULENKO, V.S.; KONSHINA, T.I.; SHAKHOVA, T.P.;  
 NYASHINA, A.A.; YASINSKAYA, Z.A.; AGAL'TSEVA, N.B.; ~~SEL'MENSKAYA,~~  
 Ye.G.; KRETSMER, V.L.; KONONOVICH, L.K.; FEDORATEVA, I.M.; TKACHEK,  
 L.Ya.; VYATKINA, G.A.; SLOUSHCH, V.S.; RACHINSKAYA, L.N.; PORTNAYA,  
 R.Yu.; KARAKOVSKAYA, E.M.; POKROVSKAYA, M.A.; KORNEVA, A.I.;  
 YERSHOVA, K.F., otv. red.; Primal uchastiye KAMANOV, M.I., red.;  
 LAGAREVA, A.P., otv. za vypusk; NIKITINA, I.P., tekhn. red.

[Economy of Novosibirsk Province; collection of statistics] Narodnoe  
 khoziaistvo Novosibirskoi oblasti; statisticheskii sbornik. Novo-  
 sibirsk, Gosstatizdat TsSU SSSR, 1961. 331 p. (MIRA 15:6)

1. Novosibirsk. Oblastnoye statisticheskoye upravleniye. 2. Na-  
 chal'nik Statisticheskogo Upravleniya Novosibirskoy oblasti (for  
 Yershov). 3. Zamestitel' nachal'nika Statisticheskogo Upravleniya  
 Novosibirskoy oblasti (for Kamanov).  
 (Novosibirsk Province—Economic conditions)

KRAVCHIK, Feliks Ivanovich; KANEVSKIY, I.L., retsenzent; LAPINA, N.V.,  
retsenzent; DZHELOMANOV, T.L., nauchnyy red.; SHAKHNOVA, V.M.,  
red.; SHISHKOVA, L.M., tekhn. red.

[Planning and organization of the repair of ships] Planirovanie  
i organizatsiya remonta sudov. Leningrad, Gos.soyuznoe izd-vo  
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(Ships--Maintenance and repair)

POLOTSKIY, Solomon Gertsovich; LOGINOV, S.P., kand. ekon. nauk, retsenzent;  
SATANOVSKIY, Ya.S., inzh., retsenzent; SHUL'KIN, P.S., nauchnyy  
red.; SHAKHMOVA, V.M., red.; TSAL, R.K., tekhn. red.

[Some problems in the economics of shipbuilding] Nekotorye voprosy ekonomiki sudostroeniia. Leningrad, Gos. soiuзное izd-vo sudostroit. promyshl., 1961. 194 p. (MIRA 15:2)  
(Shipbuilding)

BOYTSOV, Gennadiy Vladimirovich; NEBYLOV, Vladimir Matveyevich;  
TAUBIN, Georgiy Osipovich. Prinimal uchastiye SHAVROV, Yu.N.;  
BAYKOV, D.I., kand. tekhn.nauk, retsenzent; KOROTKIN, Ya.I.,  
kand. tekhn.nauk, retsenzent; SHAKHNOVA, V.M., red.; TSAL,  
R.K., tekhn. red.

[Strength of ship structures from aluminum alloys; design and  
calculations] Prochnost' sudovykh konstruksii iz aliumineievykh  
splavov; proektirovanie i raschet. Pod obshchei red. G.O.Taubina.  
Leningrad, Sudpromgiz, 1962. 211 p. (MIRA 15:7)  
(Hulls (Naval architecture)) (Aluminum alloys)

RUSO, Vladimir Leonidovich; KOROBOV, P.D., inzh., retsenzent;  
RAZDUY, F.I., kand. tekhn. nauk, retsenzent; ALSUF'YEV,  
P.A., nauchnyy red.; SHAKHNOVA, V.M., red.; KOROVENKO,  
Yu.N., tekhn. red.

[Welding aluminum alloys in an inert gas atmosphere] Svar-  
ka aluminievyykh splavov v sred $\bullet$  inertnykh gazov. Lenin-  
grad, Sudpromgiz, 1962. 160 p. (MIRA 15:8)

(Aluminum alloys--Welding)  
(Protective atmospheres)



NOGID, Lev Markovich; GIRS, I.V., kand.tekhn.nauk, retsenzent;  
SHPAKOV, V.S., kand.tekhn.nauk, retsenzent; DORIN, V.S.,  
nauchnyy red.; SHAKHNOVA, V.M., red.; SHISHKOVA, L.M.,  
tekhn. red.

[Planning the shape of a ship and preparing preliminary drawings]Proektirovanie formy sudna i postroenie teoreticheskogo chertezha. Leningrad, Sudpromgiz, 1962. 242 p.

(MIRA 15:8)

(Hulls (Naval architecture))

BYAKOV, Miron Romanovich [deceased]; URETSKIY, Moisey Lazarevich;  
MINYAYEV, V.I., retsenzent; TSVENEV, V.L., retsenzent;  
SATANOVSKIY, Ya.S., nauchnyy red.; SHAKHNOVA, V.M., red.;  
KOROVENKO, Yu.N., tekhn. red.

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(Shipbuilding--Management)

OKERBLOM, Nikolay Oskarovich; DEMYANTSEVICH, Vladimir Petrovich;  
BAYKOVA, Iraida Petrovna; BENUA, F.F., kand. tekhn.nauk,  
retsenzent; MATSKEVICH, V.D., kand. tekhn.nauk, retsenzent;  
SAGALOVICH, D.N., kand. tekhn. nauk, nauchn. red.; SHAKHNOVA,  
V.M., red.; KOROVENKO, Yu.N., tekhn. red.

[Planning the procedure for the manufacture of welded structures; design methods] Proektirovanie tekhnologii izgotovleniia  
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giz, 1963. 602.p. (MIRA 16:9)

(Structural frames--Welding)  
(Welding--Tables, calculations, etc.)

REYNOV, Mikhail Naumovich; BREGMAN, Vladimir Il'ich; MOSKALENKO,  
Vladimir Mikhaylovich; NAKHIMOVICH, Eduard Mikhaylovich;  
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AKSENOV, Yevgeniy Mikhaylovich; ROMANOV, B.N., inzh.,  
retsenzent; SHAKHNOVA, V.M., red.; FRUMKIN, P.S., tekhn.red.

[Shipbuilding calculations on electronic computers] Sudo-  
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shinakh. [By] M.N.Reinov i dr. Leningrad, "Sudostroenie,"  
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Vasim Davidovich [deceased]; AIRUKH, M.G., inzh.  
retsenzent; IVCHKIN, V.F., inzh., retsenzent; SAIMNOV,  
V.I., nauchn. red.; SHAKHNOVA, V.M., red.

[Motorboats and launches made of plastics] Shliupki i ka-  
tera iz plastmass. Leningrad, Izd-vo "Sudostroenie,"  
1964. 263 p. (MIRA 17:6)

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ALEKSANDROV, M.N., kand. tekhn. nauk, retsenzent;  
MALOMEDOV, A.N., inzh., retsenzent; KRAKOVSKIY, I.I.,  
doktor tekhn. nauk, prof., nauchn. red.; SEAKHNOVA,  
V.M., red.

[Anchor and mooring gear; design and calculation]  
IAkornye i shvartovnye ustroystva; proektirovanie i  
raschet. Leningrad, Sudostroenie 1964. 415 p.  
(MIRA 18:1)

SMIRNOV, Vasil'y Ivanovich; MESHCHERYAKOV, Vasil'y Vasil'yevich;  
SMIRNOVA, M.K., kand. tekhn. nauk, retsenzent; AL'SHITS,  
I.M., nauchn. red.; SHAKHNOVA, V.M., red.

[Testing and inspecting glass reinforced plastics used in  
shipbuilding] Ispytanie i kontrol' sudostroitel'nykh  
stekloplastikov. Leningrad, Sudostroenie, 1965. 186 p.  
(MIRA 18:6)

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DIYEV, B.F., kand. tekhn. nauk, ratsenzent;  
KOPEYETSKIY, V.V., kand. tekhn. nauk, ratsenzent;  
RUDETSKIY, A.A., nauchn. red.; SHAKHNOVA, V.M., red.

[Water jet propellers; theory and calculations] Vodomet-  
nye dvizhiveli; teoriya i raschet. Leningrad, Sudo-  
stroenie, 1965. 271 p. (MIRA 18:3)



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SHAKHNOVA, V.M., red.

[Automatic gas cutting in shipbuilding] Opyt avtomaticheskoi gazovoi rezki v sudostroenii. [zd.2., ispr. i dop. Leningrad, Sudostroenie, 1965. 127 p. (MIRA 19:1)

SHAKHNOVICH, A. I.

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HD9715.R92S4

SAMOYLOV, A.Ya., prof., SHAKHNOVICH, A.P.

Local pupillography in neuro-ophthalmological diagnosis. Vop.  
neirokhir. 22 no.3:20-25 My-Je '58 (MIRA 11:8)

1. Nauchno-issledovatel'skiy ordena Trudovogo Krasnogo Znameni  
institut neyrokhirurgii imeni akad. N.N. Burdenko AMN SSSR.  
(PUPILS,

pupillography, diag. value (Rus))

SHAKHNOVICH, A.R.

Cinematographic investigation of the cochleopapillary reflex. Vest.  
oto-rin. 16 no.4:76-77 J1-Ag '54. (MLRA 7:8)

1. Iz kafedry normal'noy fiziologii (zav. prof. A.T.Pshonik)  
Krasnoyarskogo meditsinskogo instituta.

(REFLEX,

\*cochleopapillary reflex, cinematography)

(COCHLEA, physiology,

\*cochleopapillary reflex, cinematography)

(PUPILS, physiology,

\*cochleopapillary reflex, cinematography)